

DATE: August 26, 2003

TO: ODW Staff

THROUGH: Robert B. Taylor, P.E., Director  
Office of Drinking Water

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SUBJECT: Emergency Response – M256A1 Chemical Agent Detector Kit

## Background

In the event that a known or suspected weapons of mass destruction (WMD) incident occurs involving a chemical warfare agent (CWA), it may be necessary for selected ODW staff on the scene to test for CWAs. The M246 series Chemical Agent Detector Kit is an essential element in chemical defensive measures. It is used to detect hazardous concentrations of blood, nerve, and blister agents and selected ODW staff may be required to use the kit or to instruct others on the use of the kit. The kit is only one type of detector to be inventoried by ODW.

## Kit Description

The M256A1 has two test components. The first, the M256A1 Vapor-Sampler, tests vapors for the presence of nerve agents, blood agents, and blister agents. The other component, the ABC-M8 Chemical Agent Detector Paper, tests liquids for the presence of nerve agents and blister agents. The third component is a set of operational instruction cards.

## Procedures

Although one person can run the tests, it is best for two people to use the Vapor-Sampler. One person reads the instructions included in the kit on cards and the other to perform the test. Also, bare-bones instructions are printed on both sides of the vapor-sampler protective envelope. More detailed procedures are found in the attached instructions which will become part of a WMD annex to the ODW emergency response plan.

## Maintenance

Maintenance consists of ensuring each kit:

- Is adequately stocked,
- has its vapor-sampler's discard date checked (and expired envelopes discarded/replaced), and
- that each protective envelope is intact.

For the near future, the M256A1 kits will be maintained at the Central Office and delivered to the field office(s) included in a “push package.” ABC-M8 Paper, not part of the kit, will be procured and distributed to the field offices. These are relatively small and do not require much space and no maintenance. Shelf life is not a problem for the M8 paper. Procurement of test kits and replacements of components will be a Central Office responsibility.

### **Training**

As replacement components become available and components reach their shelf life, staff will receive training on use of the kit. Central Office staff will schedule and conduct training.

Attachment

## I. SUMMARY

The M256 series Chemical Agent Detector Kit (including both the M256 and M256A1 is an essential element in chemical agent defensive measures. It is used to detect hazardous concentrations of blood, nerve, and blister agents. The Office of Drinking Water has the M256A1 test kit.

In a response situation, each person is responsible for observing his or her surroundings for signs of chemical warfare agent. Warning signs vary depending on the chemical warfare agent used and the delivery method. Warning signs include spraying from low unidentified aircraft; animals with no apparent or observable cause of death; dead insects, especially those on animal carcasses; and individuals who are experiencing or demonstrating symptoms consistent with exposure to a chemical warfare agent. Two persons normally conduct a test with the M256A1 – one person reads the instructions that come with each kit while the second person performs the action. However, an unassisted individual can perform tests using the M256A1 when necessary.

The M256A1 is used to test for the presence of hazardous concentrations of blood, nerve, and blister agents in vapor, and nerve and blister agents in liquid form. The M256A1 has two primary test components – the vapor-sampler and M8 detection paper. The vapor-sampler is similar to a miniature chemistry set. All materials (solids and liquids) required to test vapors and aerosols are contained within the vapor-sampler's body. M8 detection paper is similar to litmus (pH) paper. The difference is that M8 paper is specifically designed to react to nerve agents and blister agents in liquid form.

The detection kit relies on a reaction between the chemicals and enzyme used in the vapor-sampler, or those impregnated within M8 paper, and a chemical warfare agent to produce a uniquely colored response. The colored response is compared to color charts to determine whether a chemical warfare agent is present. It takes 15 to 20 minutes to detect the presence of a blood agent, nerve agent, or blister agent using the M256A1 test kit, which includes a 10-minute period when the vapor-sampler is exposed to the gas or vapor in question. Test results, positive or negative, are then used as a factor, along with the aforementioned signs and the test results received from other chemical warfare agent detection equipment, to determine if personnel can remove their protective equipment.

In some instances, the M256A1 kit can produce a false positive or a false negative test result. A false positive detection indicates the presence of a hazardous concentration of a chemical warfare agent when no agent is present. A positive result for nerve agent should be verified by conducting a second test using a vapor-sampler with a different lot number than the first or by using an alternate detection system such as an M8A1 chemical agent alarm or Chemical Agent Monitor (CAM). A false negative detection indicates an agent is not present when one actually exists. Of the two types, a false negative detection is more serious because it can lead to an exposure to a chemical warfare agent that might otherwise be preventable. Extensive testing with known chemicals and compounds expected to be encountered indicate that a false negative detection, although possible, is unlikely. However, a false positive detection can occur if an outdated kit is used, if a kit is inadvertently exposed to some pollutants, or if the kit is used improperly.

## II. INTRODUCTION

The M256A1 Chemical Agent Detection Kit is one of several types of alarms and detection equipment the US military uses to detect the presence of chemical warfare agents (CWAs). The US Army began using the M256 kit in 1978. However, the kit could not detect the nerve agent VX at a concentration level that was low enough to prevent injury to personnel. This deficiency was corrected by developing the M256A1, which is identical in appearance to the original M256A1 and has the same operator's manual. The only difference between the two versions is the sensitivity of the nerve agent vapor detection. The M256A1's nerve agent test is ten times more sensitive than the M256A1's nerve agent test. This means that the M256A1 can detect nerve agents such as VX at a concentration level that is below the concentration level that would injure personnel.

## III. DESCRIPTION

### A. Background

Among the many tasks and responsibilities that each responder has at known or suspected weapons of mass destruction (WMD) incident site is to observe their surroundings for signs of chemical warfare agents (CWAs). Warning signs vary depending on the chemical agent used and the delivery method. Automatic sensors can help, but there are other more conventional warning signs. These warning signs include spraying from low flying unidentified aircraft; the sighting of dead animals with no apparent or observable cause of death; dead insects, especially those on animal carcasses; and individuals who are experiencing or demonstrating symptoms consistent with exposure to a CWA. If the presence of CWA is suspected, individuals in the area are alerted so that they can move upwind and out of the impacted area or don their protective equipment. Once everyone has suited up, the environment must be tested to determine whether a CWA is present and, if one is present, determine its type. One way to accomplish this task is to use the M256A1 Chemical Agent Detector kit.

The M256A1 kit is a manually operated chemical warfare agent detector. It is used to determine whether it is safe to remove the protective mask following a chemical warfare agent attack, or as a confirmatory test after a chemical agent alarm has sounded. The M256A1 is not an alarm; it is a tool used after responders have received other warnings about the possible presence of chemical warfare agents, and have responded by putting on their chemical protective clothing. Proper use of the M256A1 enables incident commanders to determine if CWAs are present, or if they can remove some protective clothing. The M256A1 detects the presence of hazardous concentrations of blood, nerve, and blister agents in both vapor and liquid form.

Shelf life of the vapor sampler for nerve agent is five years. Kit age does not affect the blood agent test, blister agent test and lewisite test. A positive result for nerve agent should be verified by conducting a second test using a vapor-sampler with a different lot number than the first or by using an alternate detection system such as an chemical agent alarm or Chemical Agent Monitor (CAM).

## B. M256A1 Kit Description

One person can easily carry the M256A1 kit. It is contained in a high-impact plastic carrying case that measures seven inches high, five inches wide, and three inches in depth. The entire kit weighs 1.2 pounds. The kit can operate in temperatures ranging from minus 25 degrees F (-32 degrees C to 120 degrees F (49 degrees C). Aside from its carrying case, the M256A1 kit has three basic components: vapor-samplers, M8 chemical agent detector paper, and a set of operational instruction cards (Figure 1). These components are designed so that an individual in full Personal Protective Equipment (PPE) can perform the appropriate tests.



Figure 1. M256 Chemical Agent Detection Kit.

### 1. M256A1 Vapor-Sampler

As its name implies, the M256A1 vapor-sampler (Figures 2 and 3) is used to test vapors for the presence of nerve agents, blood agents, and blister agents. It is the primary testing device in the M256A1 kit. When issued, each new M256A1 kit contains 12 of these miniature chemistry sets individually sealed in a plastic laminated foil envelope. **To minimize the chance of error, two persons should conduct a vapor-sampler test; one person reads the instructions and the second person performs the action.** When necessary, one person can successfully operate the vapor-sampler. An individual vapor-sampler is used once and discarded. Because each vapor-sampler contains about **2.6 milligrams of mercuric cyanide**, used samplers must be handled as **hazardous waste** and disposed of in accordance with the applicable service's regulation regarding hazardous waste disposal.

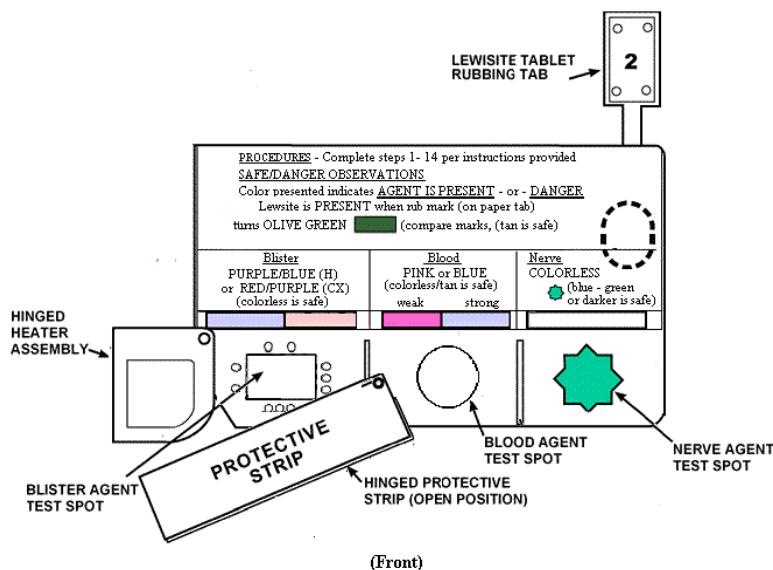


Figure 2. Vapor Sampler (front view).

The vapor-sampler's plastic body holds the test components and connects the components of each individualized test to each other. Each sampler body has several glass ampoules, one hinged heater assembly, three test spots, one hinged protective strip, and a lewisite-detecting tablet with rubbing tab.

The glass ampoules contain various chemical solutions, called reagents that react in predictable ways to the vapor forms of nerve, blood, and blister agents. The glass ampoules are used in the individual chemical agent tests in which two heater ampoules are used with the heater assembly in the blister agent tests. The ampoules are visible from the back of the vapor-sampler and are connected to their appropriate test spot by a channel molded into the plastic vapor-sampler body. Ampoules are crushed between gloved fingers to release the reagents contained within.

There are three test spots, one for each of three CWA tests. Each test spot is positioned on the sampler body to minimize the chance of cross-contamination between test spots and ensure both sides of each spot are exposed to the suspect vapor. To assist the operator in identifying the test being conducted, each test spot is shaped differently.

The name of each test (nerve, blood, and blister) is also printed above each test spot. Each test spot is made from a different material selected for its strength, sensitivity, functionality, and reliability. The nerve agent test spot is star shaped and made from filter paper. The blood agent test spot is round and made from a glass fiber filter. Lastly, the blister agent test spot is square and is made of chromatographic media .

The remaining components—the hinged heater assembly, hinged protective strip, and a lewisite rubbing tablet—are connected to the sampler body by rivets and a tab. The vapor-sampler's heater is used with the blister agent test spot. The heater improves the evaporation of the blister agent test reagents, which helps the test achieve its required sensitivity. It generates heat through a chemical reaction from chemicals in the heater's ampoules. It is riveted to the sampler body so that the operator can swing the heater over the blister agent test spot to conduct the test and swing it back out of the way to observe the test results. The protective strip is also riveted to the sampler body. It is positioned over the blood and nerve agent test spots to help protect them from accidental contamination. Finally, the lewisite detection tablet is covered by a protective plastic pull-tab that must be opened before use.

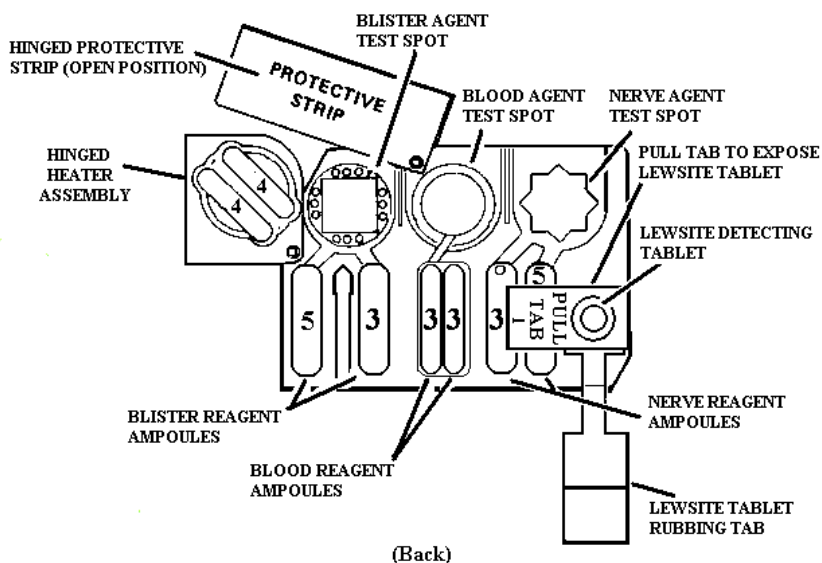


Figure 3. Vapor Sampler (back view).

## 2. ABC-M8 Chemical Agent Detector Paper (M8 Paper)

M8 paper (Figure 4) is used to test liquid substances for the presence of nerve agents and blister agents. It is similar to the litmus (pH) paper that is found in almost any laboratory in that a test result is indicated in both types of paper by a change in color. The difference is that M8 paper is specifically designed to react to nerve agents and blister agents in liquid form. It cannot be used to test vapors for the presence of CWAs. It is also issued to individuals as a separate piece of CWA detection equipment. Each M256A1 kit comes with one booklet of M8 paper that contains 25 sheets. Unused M8 paper is tan in color and has three sensitive indicator dyes suspended within the paper. M8 paper responds (changes color) within 30 seconds of exposure to liquid G and V nerve agents and H or L blister agents. Each of these CWAs has a different level of acidity (pH). The detector dyes react to the different pH levels by changing to one of three colors. The color yellow indicates the presence of a G nerve agent; the color green indicates a V nerve agent. Exposure to either H or L blister agents produces a red color (see Figure 5). M8 paper does not have to be completely saturated with a liquid chemical agent to produce a test result. It reacts to a liquid measure as small as 0.02 milliliter (a drop or two).

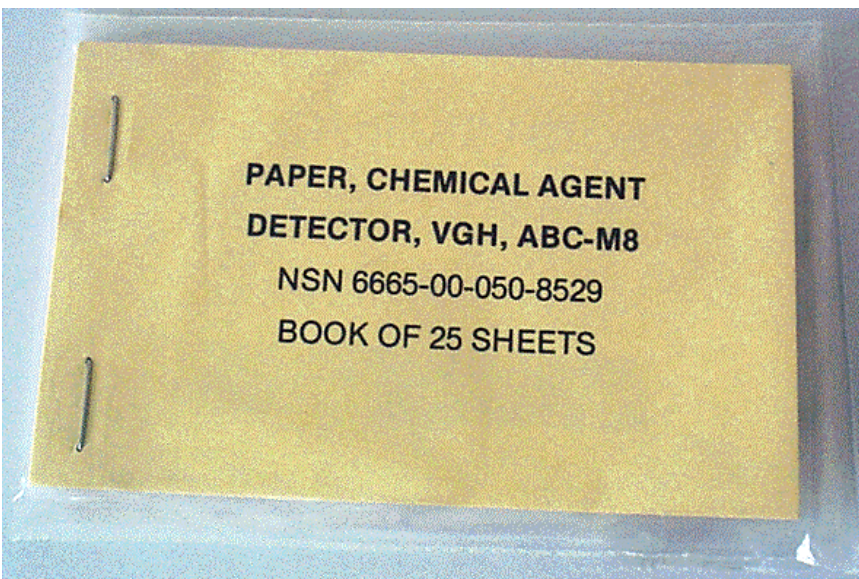


Figure 4. M8 Paper.



Figure 5. M8 paper and color chart with an example of a positive indication of an H or L blister agent.

### 3. Sensitivity to Chemical Warfare Agents

The amount of a CWA absorbed through the skin or inhaled over a period of time is referred to as the dose that an individual has received. Although each person responds in a predictable way (e.g., develops burns and blisters on the skin, develops blurred vision, or loses consciousness, etc.) after becoming exposed to a CWA, the time it takes for symptoms to first appear may vary slightly from individual to individual. In addition, the dose that an individual must absorb to cause a reaction can also vary slightly from individual to individual. Dosage levels have been established that will predictably cause a reaction in a defined percentage of a population. The two dosage designations used in this paper are the *effective dose* (that which causes an effect in a defined percentage of a population) and *lethal dose* (that which causes death in a defined percentage of the population). The effective dose has been established for most CWAs, while the lethal dose is generally known for all CWAs. In addition, the effective dose may differ from the lethal dose for an agent depending on its form, liquid or vapor. Effective dose and lethal dose are further explained in Table 1.

*Table 1. Explanation of effective dose and lethal dose*

Chemical Warfare Agent	Dosage	Explanation
Liquid Form	Effective Dose: ED <sub>50</sub>	The letters E or L differentiate between effective and lethal doses and the subscript number depicts the applicable percentage of the population. In this case, the number 50 represents 50 percent of the population; 25 percent of the population would be identified as ED <sub>25</sub> or LD <sub>25</sub> .
	Lethal Dose: LD <sub>50</sub>	
Vapor Form		The letters E or L differentiate between effective and lethal doses and the subscript number depicts the applicable percentage of the population (the number 50 represents 50% of the population). The letter C represents the concentration or the amount of agent that is suspended in one cubic meter (m <sup>3</sup> ) of air (e.g., 10 mg, 20 mg, 50 mg, etc.); the letter t represents the period of exposure in minutes. A lethal dose expressed as: LC <sub>t50</sub> 5 mg x minute/m <sup>3</sup> means that 50% of the population would die if they received a dose that consisted of a concentration of 5 milligrams of agent for one minute (5 multiplied by 1) in one cubic meter (m <sup>3</sup> ) of space.

To prevent injury and death to personnel, the M256A1 kit must be capable of detecting the presence of a CWA at a concentration level that is lower than a concentration level that could injure personnel. This assists incident commanders, or other responsible individuals, to determine if a CWA's concentration is below a casualty-producing level and that it is safe to remove PPE gear. Table 2 provides a comparison between the known effective and lethal doses of CWAs and the M256A1 kit's minimum effective detection capability. The purpose for including this tables is to show the effectiveness of the M256A1 kit in detecting CWAs at much lower levels than CWAs are known to cause injuries and death.

*Table 2. Comparison of effective and lethal doses of chemical warfare agents with the M256A1 Detection Kit's minimum detection capability*

	Agent	Liquid		M8 Paper	Vapor/Aerosol (mg x minute/m3)		M256 Vapor-Sampler
		Effective Dose (ED <sub>50</sub> )	Lethal Dose LD <sub>50</sub> (skin)		Effective Dose (EC <sub>t50</sub> )	Lethal Dose (LC <sub>t50</sub> )	
Nerve	GA	*	1 g/70-kg man	0.02 ml	2 – 3 mg <sup>†</sup>	400 mg	0.005 mg
	GB	*	1.7 g/70-kg man	0.02 ml	3 mg <sup>†</sup>	100 mg	0.005 mg
	GD	*	350 mg/70-kg man	0.02 ml	1 mg <sup>†</sup>	50 mg	0.005 mg
	GF	*	30 mg	0.02 ml	1 mg	*	0.005 mg
	VX	1 mg	10 mg/70-kg man	0.02 ml	<1 mg <sup>‡</sup>	10 mg	0.02 mg
Blister	H	10 ug	7g/70-kg man	0.02 ml	10 mg	1,500 mg	2 mg
	HD	10 ug	7g/70-kg man	0.02 ml	10 mg	1,500 mg	2 mg
	CX	*	*	na	300 mg	3,200 mg	3 mg
	L	15 ug <sup>‡</sup>	40 – 50 mg/70-kg man	0.02 ml	Eye: 30 mg Skin: 200 mg	1,500 mg	9 mg
Blood	AC	*	100 mg	na	–1500 mg	2,500 - 5,000 mg	9 mg
	CK	*	*	na	*	11,000 mg	8 mg

\*Indicates that a dose has not been reliably estimated.

† The approximate amount that would cause pinpointing of the eye (miosis) when the eye comes into direct contact with the chemical agent as opposed to exposure through inhalation (respiratory) or being absorbed through the skin (percutaneous).

‡ The approximate amount that would cause redness or inflammation of the skin (erythema).

#### 4. Instructions for Using the M256A1 Kit

Instructions, warnings, and advisory information for operating the M256A1 kit test components are contained in the operator's manual. For ease of use under battlefield conditions, several variations of the instructions have been prepared with battlefield conditions in mind. A condensed version of the vapor-sampler's instructions and advisory information are printed on plastic laminated instruction cards that accompany each kit (Figure 6). Although the instruction

cards do not provide the same level of detail as the operator's manual, they are sufficient to guide an operator through the test from start to finish as well as to interpret test results. The cards provide step-by-step instructions for using the sampler. They also provide diagrams to aid the operator in identifying the sampler's components, and color charts for interpreting test results. Instructions are printed on both sides of the card so the operator need only flip a card up to move from the bottom of one page to the top of the next. In addition to the instruction cards, a bare bones version of the instructions and advisories are printed on both sides of the vapor-sampler's protective envelope (Figure 7).

**There are no step-by-step instructions for using M8 detection paper other than those contained in the operator's manual.** A color chart used to interpret test results is located on the inside front cover of each tablet of M8 paper (Figure 5).

#### IV. OPERATIONAL DETAILS

##### A. How the M256A1 Vapor-Sampler Works

Each type of CWA has its own unique chemical make-up that produces a predictable colored reaction when mixed with certain other chemicals. When using the vapor-sampler to test vapors

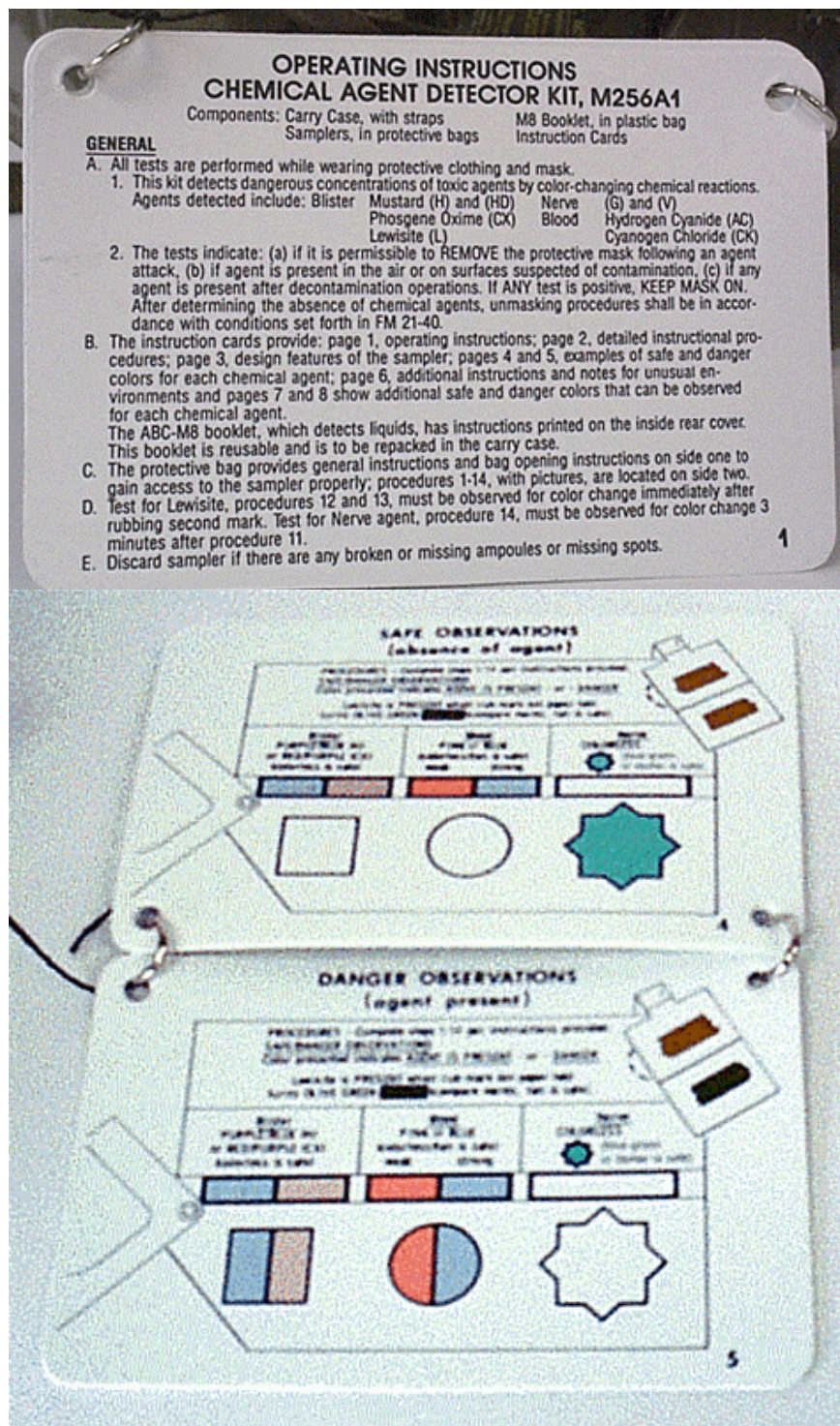


Figure 6. M256A1 Test Kit Instructions.

and aerosols, the colored reaction indicates whether a CWA is present. **It takes 15 to 20 minutes to detect the presence of a blood agent, nerve agent, or blister agent using the M256A1 test kit,** which includes a ten-minute period when the vapor-sampler is exposed to the gas or vapor in question. After the test is complete, the operator compares the test spots with the positive (danger) and negative (safe) test result examples printed both on the instruction cards and on the vapor-sampler body.

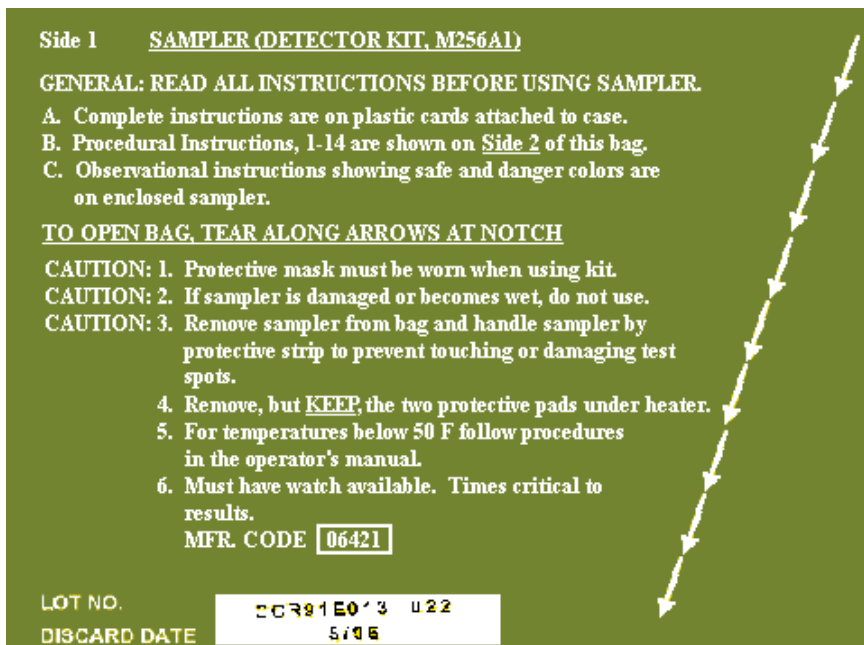


Figure 7. Vapor-Sampler's instructions on side 1 of the protective envelope.

#### 1. Blood Agent Test and Blister Agent Test

When performed successfully, both the blister agent test and blood agent test will produce a uniquely colored result. If either agent is present at a concentration level that is equal to or greater than the M256A1 kit's minimum detectable concentration level, the agent-specific color will develop on the test spot.

To perform the blister agent test, the appropriate glass ampoule marked with the number "3" (Figure 8) is crushed. This releases a solution known as 4-(4-Nitrobenzyl) Pyridine (DB3) and mercuric cyanide in methanol that flows down its channel to moisten the square-shaped blister agent test spot. The solution reacts with both H series blister agents and CX. Next, the moistened test spot is heated using the attached chemical heater for two minutes. After heating, the blister agent test-spot is exposed to the suspect vapor for ten minutes. During the exposure period, the vapor-sampler can be laid down or held

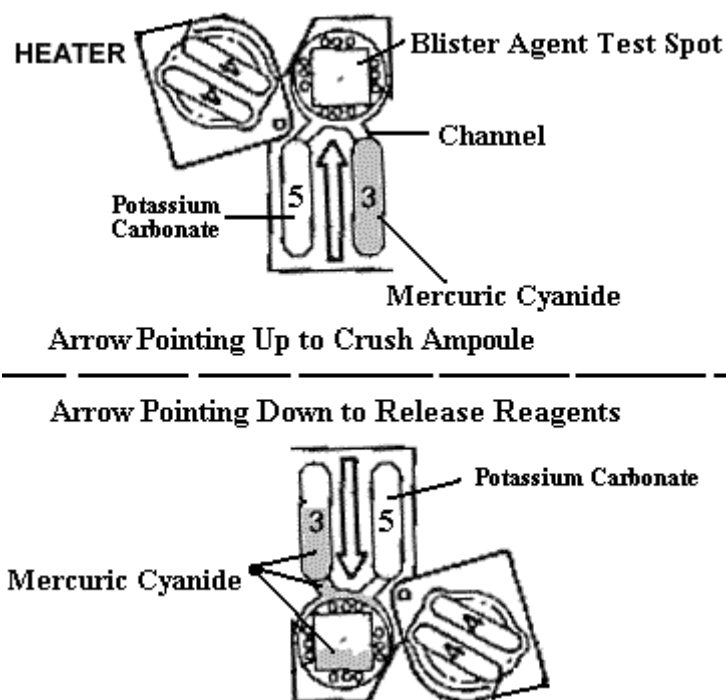


Figure 8. Releasing blister agent test reagents.

by the hinged protective strip to expose the vapor-sampler to the suspect vapor. After ten minutes, the blister agent test-spot is heated a second time for one minute. After heating, the glass ampoule marked with the number “5” is crushed to apply a potassium carbonate solution to the test spot. If an H blister agent is present, the potassium carbonate causes the spot to turn blue-purple. If CX is present, the spot will turn pink or red.

Blood agents (AC and CK) are detected using the round-shaped test spot that has been impregnated with barbituric acid. To initiate the blood agent test, the operator crushes the two glass ampoules in the center of the vapor-sampler and marked with the number “3” (Figure 9). This releases test reagents — sodium hypochlorite and a solution of 4-benzyl pyridine in 2-methoxy ethanol. If the blood agent AC is present, the sodium hypochlorite converts it to the blood agent CK. CK reacts with pyridine to form the pink-red or blue color.

The operator compares the color of the test blister agent and blood agent test spots against the safe observation and danger observation diagrams which are part of the instructions that come with each M256A1 kit (Figure 10). The operator can also compare the color changes against the safe-danger observation information that is included on the front side of each vapor sampler.

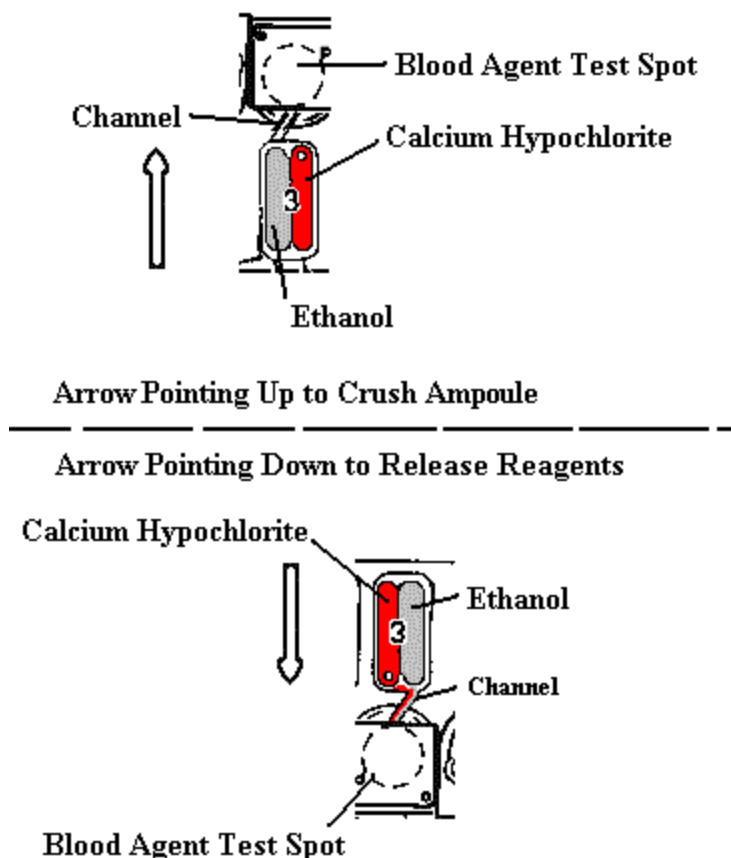


Figure 9. Releasing blood agent test reagents.

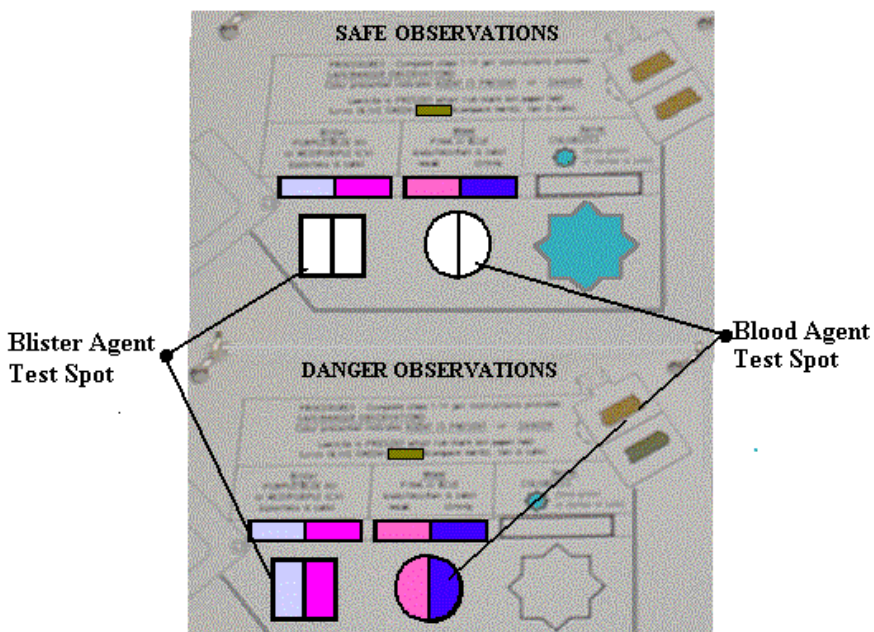


Figure 10. Example of blood agent and blister agent test results.

## 2. Lewisite Test

The lewisite test has two components: a tan colored, crayon-like pellet (containing Milcher's thioketone and other inert solids) and a paper-rubbing pad. The pellet is contained in a plastic cup molded into the vapor-sampler's body.

The paper-rubbing pad, which is white in color, is located on the underside of the tab (inset in Figure 11).

When performed successfully, the lewisite test will also produce a uniquely colored result. If lewisite is present at a concentration level that is equal to or greater than the M256A1 kit's minimum detectable concentration level, the agent specific color (olive green) will develop on the rubbing paper.

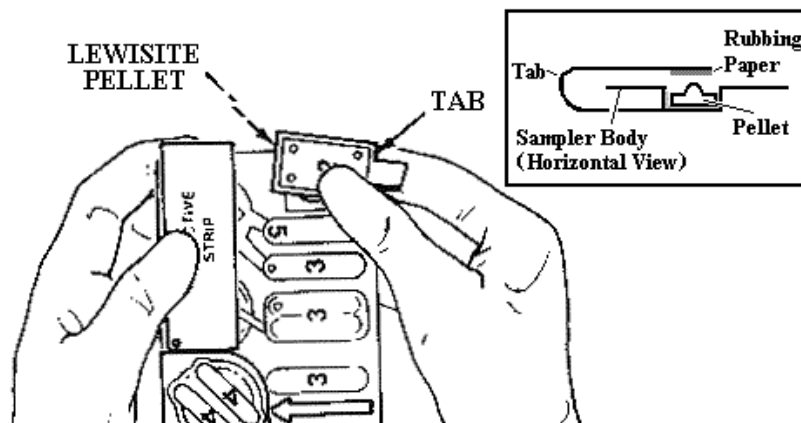


Figure 11. Rubbing the lewisite pellet and paper rubbing pad.

To conduct the lewisite test, the paper pad is rubbed against the test pellet (Figure 11).

About ten minutes later, as directed by the M256A1 kit's directions, a second rub mark is made on the paper. The two marks are then compared to each other. If the color of the first mark has turned to olive green, lewisite is present. If the first mark remains tan in color, lewisite is not present at a concentration level that would produce injury or casualties (Figure 12).

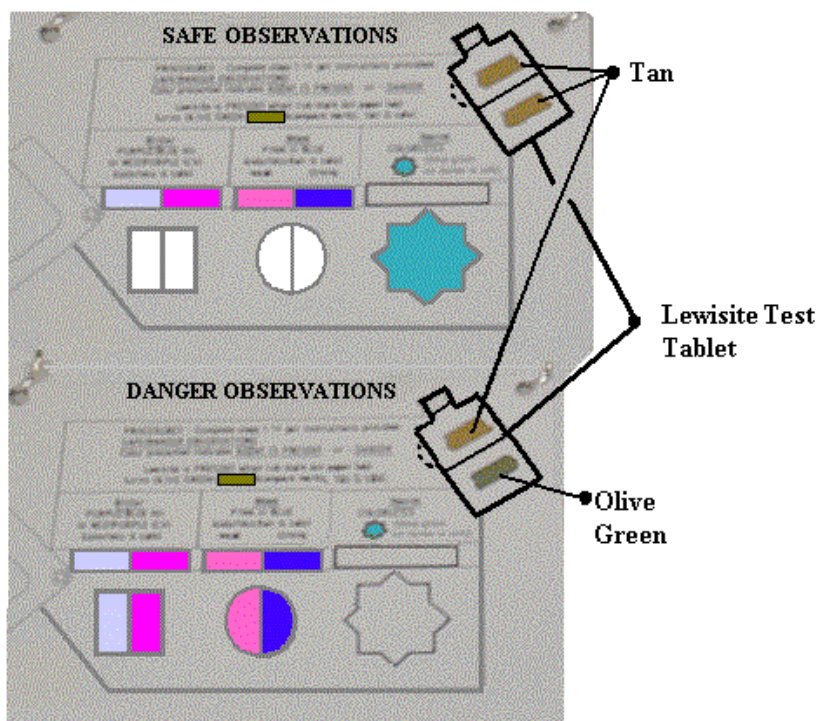


Figure 12. Example of lewisite test results..

## 3. Nerve Agent Test

The nerve agent test is conducted in the same manner as the blood and blister agent tests, i.e., glass ampoules are crushed and the test spot is moistened (Figure 13). Unlike the other chemical

agent tests (blister, blood, and lewisite), a change in the color of the nerve agent test spot from clear, or having no color, to blue-green means that no agent is present (Figure 14). The star-shaped test spot is coated with an enzyme (called acetylcholinesterase) which has been extracted from electric eels. A buffer solution from one of the glass ampoules (marked with the number “3”) is applied to the test spot to moisten the dried enzyme. After ten minutes of exposure to the air, indoxyl acetate is applied from a second ampoule (marked with the number “5”). If a nerve agent is not present, a blue color will appear on the test spot. However, if a nerve agent is present, there is no change in color to the test spot.

## B. How M8 Paper Works

To test liquids for the presence of a chemical agent, a piece of M8 paper is attached to a probe (or similar device) or held in a gloved hand. The paper is then blotted, not rubbed, into the suspect liquid. Rubbing the M8 paper into the suspect liquid may cause abrasions on the paper and cause false positive (red) detection streaks. After the M8 paper is exposed to a liquid, the person conducting the test then compares the color changes on the paper to the color chart inside the cover of the M8 paper tablet: yellow indicates the presence of a G nerve agent; green indicates VX nerve agent; and red indicates

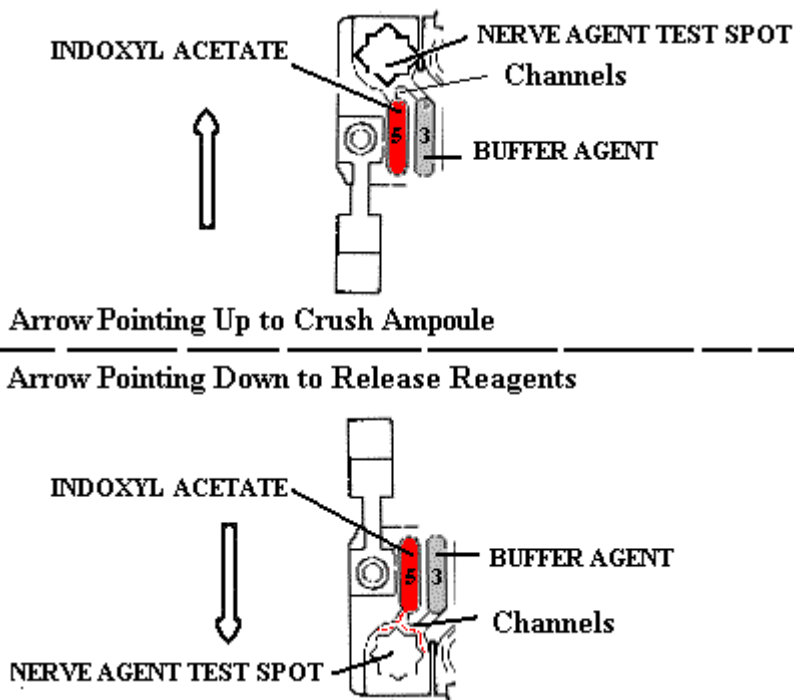


Figure 13. Releasing Nerve Agent Test Reagents.

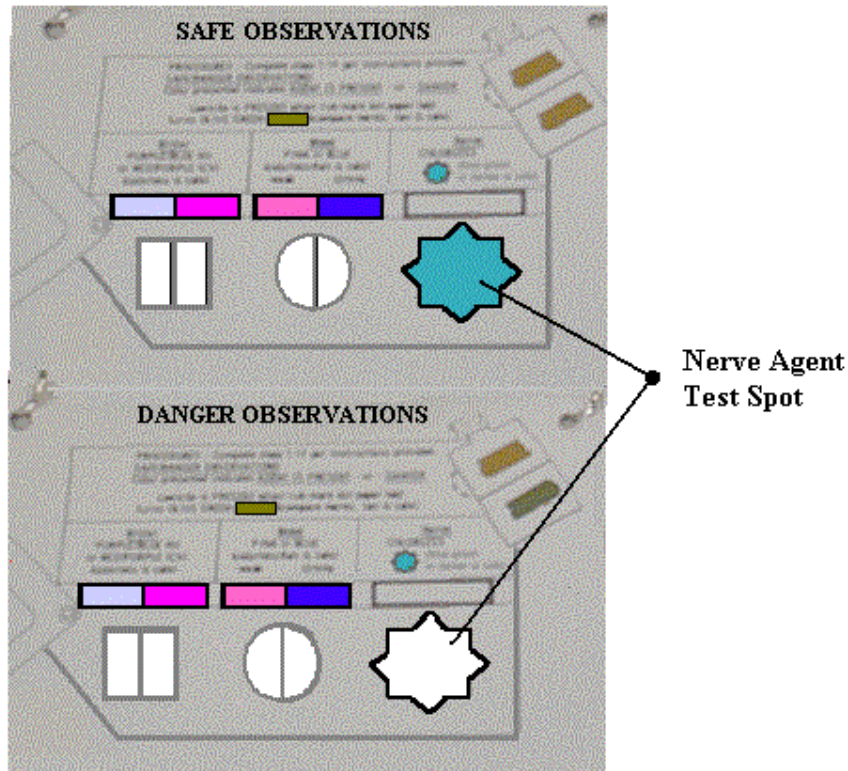
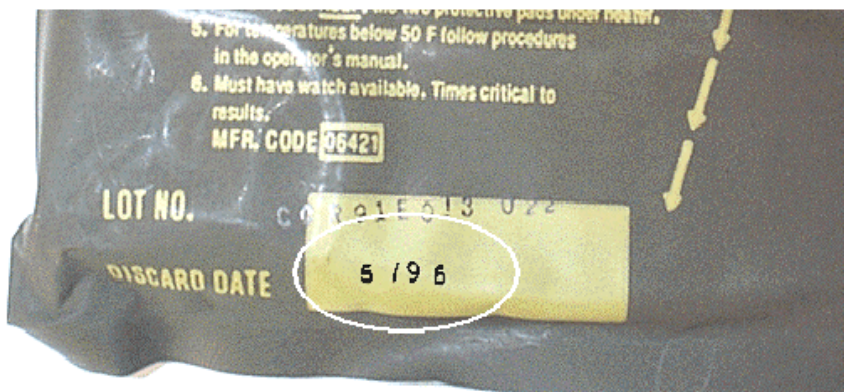


Figure 14. Example of Nerve Agent Test Results.

either H or L blister agents. If the paper does not change color, CWAs that M8 paper is capable of detecting are not present at the minimum detectable concentration level of the detection paper.

### C. M256A1 Kit Maintenance

Maintenance of the M256A1 kit is a straightforward process in which no individual part ever needs adjustment or calibration. In addition to ensuring that the carrying case is not damaged and the shoulder/waist strap is not torn or frayed, M256A1 kit maintenance consists of the following actions: 1) ensure that each kit contains 12 vapor-samplers, one book of M8 detection paper, and one set of instruction cards; 2) check each vapor sampler's discard date (expiration date) to ensure that the date has not passed or is about to pass; and 3) ensure that each vapor-sampler's protective envelope is intact. An M256A1 kit that contains four or fewer vapor-samplers can be replaced or combined with another kit having fewer than four vapor-samplers. When M256A1 kits are combined, users should observe the discard date (expiration date) on each vapor-sampler's envelope. If a vapor-sampler's discard date has passed (Figure 15), it must be replaced. The vapor-sampler should also be replaced if its protective envelope has been opened.



*Figure 15. Carrying case discard date statement (top) and vapor-sampler discard date (bottom).*

Before using a vapor-sampler, the operator must ensure that the glass reagent ampoules, test spots, or the channels connecting them are not crushed, damaged, or missing. Before conducting a chemical agent test, operators must also check the blood agent test spot for the presence of any pink colored stain. If any one of these conditions exist, the operator should get another vapor-sampler or M256A1 kit.

## V. FALSE DETECTIONS

While the M256A1 kit is described as a miniature chemistry set, conducting a test on the battlefield is far different than conducting a test in a controlled laboratory. Consequently, the possibility that a substance found at the incident site could cause the M256A1 kit to produce false detections must be considered.

Although the M256A1 kit is an improvement over older generation CWA detection kits, the M256A1 kit can produce false detections. False detections are of two types, positive and negative, with each having a vastly different outcome. A false positive detection occurs when the detector falsely indicates the presence of a CWA. False positive detections are considered an irritant or nuisance because they cause the extended and unnecessary wearing of the complete chemical protection suit, but do not lead to exposure to a CWA. A false negative detection, on the other hand, occurs when the detector falsely indicates that no chemical agent is present, when in fact it is present at or above the detector's minimum detection level, possibly at a casualty producing concentration level. A false negative detection is serious because it can cause individuals to prematurely take off their mask and gloves, and thereby expose themselves to a CWA.

## GLOSSARY

AC	Hydrogen cyanide, a blood agent.
Acetylcholine	A chemical compound that causes muscles to contract. It is found in various organs and tissues of the body. It is rapidly broken down by an enzyme, cholinesterase. Excessive production of acetylcholine (such as found in nerve agent poisoning) may result in neuromuscular block.
Acetylcholinesterase	An enzyme which stops the action of acetylcholine by separating the acetylcholine into its components of acetic acid and choline. Nerve agents combine with acetylcholinesterase to prevent it from performing its inactivation of acetylcholine.
Blister agent	A chemical warfare agent which produces local irritation and damage to the skin and mucous membranes, pain and injury to the eyes, reddening and blistering of the skin, and when inhaled, damage to the respiratory tract. Blister agents include mustards (HD and HN), arsenicals (L), and mustard and lewisite mixtures (HL).[91] Although phosgene oxime (CX) is not a blister agent[92], it is treated as one in the operation of the M256A1 kit. Phosgene oxime is more correctly referred to as an urticant.
Blood agent	A chemical warfare agent which is inhaled and absorbed into the blood. The blood carries the agent to all body tissues where it interferes with the tissue oxygenation process. The brain is especially affected. The effect on the brain leads to cessation of respiration followed by cardiovascular collapse. Examples of blood agents are AC and CK.
Chemical Agent Monitor (CAM)	A CAM is a hand-held, soldier-operated device that is used to monitor chemical warfare agent contamination on individuals and equipment.
Chemical warfare agent	A chemical substance used in military operations to kill, seriously injure, or incapacitate humans (or animals) through its toxicological effects. Excluded are riot control agents, chemical herbicides, and smoke and flame materials. Chemical agents include nerve agents, incapacitating agents, blister agents (vesicants), lung damaging agents, blood agents, and vomiting agents.
Chemical warfare	All aspects of military operations involving the employment of lethal and incapacitating munitions/agents and the warning and protective measures associated with such offensive operations.
Chromatography	A process in which a chemical mixture is separated into its individual components. The process occurs when the mixture is forced to flow through or over a stationary liquid or solid. The blister agent test spot is made from a material that acts as the stationary solid.

CK	Cyanogen chloride, a blood agent.
CS	Tear gas. Chemical name: O-chlorobenzylidene malononitrile.
CX	Phosgene oxime (see urticant and blister agent).
Enzyme	Any of the numerous complex proteins that are produced by living cells and catalyze specific biochemical reactions at body temperatures.
GA	Tabun nerve agent Ethyl N,N-dimethylphosphoroamidocyanide.
GB	Sarin-nerve agent. Isoproyl methylphosphonofluoridate.
GD	Soman nerve agent. Methylphosphonofluoridic acid 1, 2,2-trimethylpropyl ester.
GF	G-series nerve agent O-Cyclohexyl-methylfluorophosphonate.
H	H-series blister agents: A series of persistent blister agents, that include Levinstein (Sulfur) Mustards (H), Distilled Mustard (HD), Nitrogen Mustards (HN-1, HN-2, HN-3), and Mustard-Lewisite Mixture (HL).
HC	A special smoke made from petroleum oil. It is a mixture of granulated aluminum, zinc oxide, and hexachloroethane.
HD	Distilled mustard, a blister agent.
Incapacitating agent	A chemical warfare agent that produces a temporary disabling condition (physiological or psychological) that persists for hours to days after exposure has ceased.
Interferent	A substance that, when present with a chemical warfare agent at or above the minimum detectable level, causes a false negative when otherwise a true positive would have resulted.
L	Lewisite, a blister agent. Dichloro-(2-chlorovinyl)arsine.
Mercuric cyanide	A white or colorless crystalline solid that is used in medicine, germicidal soaps, photography and in making cyanogen gas. The health effects caused by exposure to mercuric cyanide vary depending on the amount of exposure and the type of exposure (liquid or gas).
Michler's thioketone	A blue powder or white-to-green-colored leaflet material. It is used as a chemical intermediate in making dyes and pigments.
Nerve agents	The most toxic chemical warfare agent. Nerve agents are absorbed into the

body through breathing, by injection, or absorption through the skin. They affect the nervous and the respiratory systems and various body functions. They include the G series and V series chemical warfare agents.

pH	Chemistry measurement of acidity and alkalinity. The pH scale goes from 0 to 14 with 7 as the neutral point. A substance with a pH lower than 7 is acidic, while a pH above 7 is alkaline.
Shelf life	The period during which an item or material may be stored and remain suitable for use.
Urticant	A substance that causes a burning or itching of the skin such as that caused by nettle stings.
V	Persistent, highly toxic nerve agents developed in the mid-1950s and absorbed primarily through the skin. V agents are generally colorless and odorless liquids which do not evaporate rapidly. The standard V agent is VX while others include Vx, and VX2.
VX	V-series nerve agent. O-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothiolate.

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